

Claims

1. A method of feeding water to the heat transfer surfaces of a falling film evaporator having vertical evaporation channels, by distributing the water as a spray of drops to the beginning of the heat transfer surfaces, **characterised** in that water soluble, essentially atmospheric gases are simultaneously separated from the water.
2. An apparatus for removing dissolved gases from water to be evaporated in connection with a falling film evaporator, which apparatus comprises vertical evaporating channels and at least one spraying device (3) for breaking the heated feed-water into a spray of droplets having a hit pattern substantially corresponding to the area of the upper end (4) of the evaporator channel arrangement, **characterised** in that it comprises at least one outlet (5) for the removal of gases separating from the droplets.
3. An apparatus as defined in claim 2, **characterised** in that it comprises a trough having a perforated bottom and lying above the upper end (4) of the evaporator channel arrangement.
4. An apparatus as defined in claim 2 or 3, **characterised** in that it comprises a substantially hemispherical chamber, the end of the evaporator tube arrangement forming the plane side thereof.

## PCT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

OY JALO ANT-WUORINEN AB  
Iso Roobertinkatu 4-6 A  
FIN-00120 Helsinki  
FINLANDE

Date of mailing (day/month/year) 08 November 2000 (08.11.00)	
Applicant's or agent's file reference 302603	IMPORTANT NOTIFICATION
International application No. PCT/FI99/00928	International filing date (day/month/year) 08 November 1999 (08.11.99)

1. The following indications appeared on record concerning:

the applicant       the inventor       the agent       the common representative

Name and Address RUSKA & CO OY Runeberginkatu 5 FIN-00100 Helsinki Finland	State of Nationality	State of Residence
	Telephone No. +358 9 694 9099	
	Facsimile No. +358 9 694 9865	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person       the name       the address       the nationality       the residence

Name and Address OY JALO ANT-WUORINEN AB Iso Roobertinkatu 4-6 A FIN-00120 Helsinki Finland	State of Nationality	State of Residence
	Telephone No. +358 9 612 6120	
	Facsimile No. +358 9 640 575	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

the receiving Office       the designated Offices concerned  
 the International Searching Authority       the elected Offices concerned  
 the International Preliminary Examining Authority       other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer S. De Michiel Telephone No.: (41-22) 338.83.38
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## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C.20231  
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 16 June 2000 (16.06.00)	
<b>International application No.</b> PCT/FI99/00928	<b>Applicant's or agent's file reference</b> 302603
<b>International filing date</b> (day/month/year) 08 November 1999 (08.11.99)	<b>Priority date</b> (day/month/year) 09 November 1998 (09.11.98)
<b>Applicant</b> SALMISUO, Mauri	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:  
 \_\_\_\_\_  
 08 May 2000 (08.05.00)

in a notice effecting later election filed with the International Bureau on:  
 \_\_\_\_\_

2. The election  was  
 was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer A. Karkachi
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

INTERNATIONAL PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

WRITTEN OPINION

(PCT Rule 66)

+ FAVL

15.11.2000

To:  
  
RUSKA & Co Oy  
Runeberginkatu 5  
FIN-00100 HELSINKI  
Finland

Date of mailing  
(day/month/year) 02-10-2000

Applicant's or agent's file reference  
302603

REPLY DUE within 45 days  
from the above date of mailing

International application No. PCT/FI99/00928

International filing date (day/month/year) 08.11.1999

Priority date (day/month/year) 09.11.1998

International Patent Classification (IPC) or both national classification and IPC<sup>7</sup>  
B01D 1/22, C02F 1/20

Applicant  
STERIS EUROPE, INC. SUOMEN SIVULIIKE et al

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
  - I  Basis of the report
  - II  Priority
  - III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV  Lack of unity of invention
  - V  Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI  Certain documents cited
  - VII  Certain defects in the international application
  - VIII  Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.
 

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also** For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis. For an informal communication with the examiner, see Rule 66.6.

**If no reply is filed**, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 09.03.2001

Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Bengt Christensson/MP Telephone No. 08-782 25 00
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WRITTEN OPINION

International application No.

PCT/FI99/00928

I. Basis of the report

1. This opinion has been drawn on the basis of (Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"):

- the international application as originally filed.
- the description, pages \_\_\_\_\_, as originally filed,  
 pages \_\_\_\_\_, filed with the demand,  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_.
- the claims, Nos. \_\_\_\_\_, as originally filed,  
 Nos. \_\_\_\_\_, as amended under Article 19,  
 Nos. \_\_\_\_\_, filed with the demand,  
 Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_.
- the drawings, sheets/fig \_\_\_\_\_, as originally filed,  
 sheets/fig \_\_\_\_\_, filed with the demand,  
 sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

2. The amendments have resulted in the cancellation of:

- the description, pages \_\_\_\_\_
- the claims, Nos. \_\_\_\_\_
- the drawings, sheets/fig \_\_\_\_\_

3.  This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

## WRITTEN OPINION

International application No.

PCT/FI99/00928

## V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement			YES
Novelty (N)	Claims	<u>3, 4</u>	NO
	Claims	<u>1, 2</u>	
Inventive step (IS)	Claims	<u>3</u>	YES
	Claims	<u>1, 2, 4</u>	NO
Industrial applicability (IA)	Claims	<u>1-4</u>	YES
	Claims		NO

## 2. Citations and explanations

The claimed invention relates to a method and an apparatus for treating water to be evaporated. Dissolved gases are removed from feed-water when using a falling film evaporator.

When producing especially clean water vapour, particularly for sterilisation purposes, the feed-water to be evaporated has to be purified of the gases dissolved therein.

The reasons that the gases have to be removed are, to maximise the concentration of the vapour that is generated and, consequently, the condensation heat, and to minimise the corrosive effect.

The removal of gases from feed-water is accomplished according to the invention by distributing the water as a spray of drops to the beginning of the heat transfer surfaces. Water-soluble gases are simultaneously separated from the water.

A process for production of pure water for boiler feed water is known from US-A-4 698 136 (fig. 1 & column 3, lines 17-31). This document is cited in the International Search Report as a document of particular relevance. Water is fed to a shower evaporator (14). The evaporator comprises a vessel (40) containing a spray system (15) in the form of spray nozzles and a heat exchanger (16) in the form of an evaporation pipe. The waters reach the spray nozzles (15) and are discharged therefrom. The waters in fine stream are distributed evenly as a thin film on the outside of the evaporation pipe of the heat exchanger (16) where they are heated to form vapours.

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## WRITTEN OPINION

International application No.

PCT/FI99/00928

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

The vapours are drawn off from the evaporator (14) by a pipe (18). The vapours, which are fed into the heat exchanger (16) comprise water vapours and non-condensable vapours such as non-condensable hydrocarbons (fig. 1 & column 3, lines 45-55).

All the features described in claim 1 are known from the document.

The apparatus disclosed in claim 2 is also known.

Claim 4 describes that the apparatus comprises a hemispherical chamber. This modification is considered obvious for a person skilled in the art to accomplish.

In accordance with the arguments stated above, the invention in claims 1 & 2 is not novel. Claim 4 is novel but is not considered to involve an inventive step, but claim 3 is considered to involve an inventive step. The claims are also considered to have industrial applicability.

WRITTEN OPINION

International application No.

PCT/FI99/00928

VI. Certain documents cited

1. Certain published documents (Rule 70.10)		Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
Application No. Patent No.	Publication date (day/month/year)		
US A 5930998	03.08.1999	04.12.1996	

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure

Date of non-written disclosure  
(day/month/year)

Date of written disclosure  
referring to non-written disclosure  
(day/month/year)



## WRITTEN OPINION

International application No.

PCT/FI99/00928

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

The use of the expression "...a hit pattern substantially corresponding to the area of the upper end of the evaporator channel...." makes claim 2 vague (PCT Article 6).

INTERNATIONAL COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT 27 FEB 2001

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 302603	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI99/00928	International filing date (day/month/year) 08.11.1999	Priority date (day/month/year) 09.11.1998
International Patent Classification (IPC) or national classification and IPC7 B01D 1/22, C02F 1/20		
Applicant STERIS EUROPE, INC. SUOMEN SIVULIIKE et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I  Basis of the report
- II  Priority
- III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV  Lack of unity of invention
- V  Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement
- VI  Certain documents cited
- VII  Certain defects in the international application
- VIII  Certain observations on the international application

Date of submission of the demand 08.05.2000	Date of completion of this report 31.01.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Bengt Christensson/MP Telephone No. 08-782 25 00

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/FI99/00928

## I. Basis of the report

1. With regard to the **elements** of the international application:\*

- the international application as originally filed
- the description:  
pages 1-4 . as originally filed  
pages \_\_\_\_\_ . filed with the demand  
pages \_\_\_\_\_ . filed with the letter of \_\_\_\_\_
- the claims:  
pages \_\_\_\_\_ . as originally filed  
pages \_\_\_\_\_ . as amended (together with any statement) under article 19  
pages \_\_\_\_\_ . filed with the demand  
pages 5 . filed with the letter of 14.11.2000
- the drawings:  
pages 1-2 . as originally filed  
pages \_\_\_\_\_ . filed with the demand  
pages \_\_\_\_\_ . filed with the letter of \_\_\_\_\_
- the sequence listing part of the description:  
pages \_\_\_\_\_ . as originally filed  
pages \_\_\_\_\_ . filed with the demand  
pages \_\_\_\_\_ . filed with the letter of \_\_\_\_\_

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.  
These elements were available or furnished to this Authority in the following language English which is:

- the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4.  The amendments have resulted in the cancellation of:

- the description, pages \_\_\_\_\_
- the claims, Nos. \_\_\_\_\_
- the drawings, sheet/fig \_\_\_\_\_

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00928

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement			YES
			NO
Novelty (N)	Claims	1-4	YES
	Claims		NO
Inventive step (IS)	Claims	1-4	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-4	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention relates to a method and an apparatus for treating water to be evaporated. Dissolved gases are removed from feed-water when using a falling film evaporator.

When producing especially clean water vapour, particularly for sterilisation purposes, the feed-water to be evaporated has to be purified of the gases dissolved therein.

The reasons that the gases have to be removed are, to maximise the concentration of the vapour that is generated and, consequently, the condensation heat, and to minimise the corrosive effect.

The removal of gases from feed-water is accomplished according to the invention by distributing the water as a spray of drops to the beginning of the heat transfer surfaces. Water-soluble gases are simultaneously separated from the water.

A process for production of pure water for boiler feed water is known from US-A-4 698 136 (fig. 1 & column 3, lines 17-31). Water is fed to a shower evaporator (14). The evaporator comprises a vessel (40) containing a spray system (15) in the form of spray nozzles and a heat exchanger (16) in the form of an evaporation pipe. The waters reach the spray nozzles (15) and are discharged therefrom. The waters in fine stream are distributed evenly as a thin film on the outside of the evaporation pipe of the heat exchanger (16) where they are heated to form vapours.

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/FI99/00928

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

The vapours are drawn off from the evaporator (14) by a pipe (18). The vapours, which are fed into the heat exchanger (16) comprise water vapours and non-condensable vapours such as non-condensable hydrocarbons (fig. 1 & column 3, lines 45-55).

This document is cited in the International Search Report as a document of particular relevance but is now considered to show the closest background art. The reason for this re-evaluation is that the subject matter in amended claim 1 of November 14, 2000 differs from the process according to the document in that the evaporator is a falling film evaporator. Furthermore, the amended claim 1 states that the gases are separated prior to the steam evaporation.

The method according to claim 1 is considered to give rise to an unexpected technical effect i.e. distributing feed-water effectively to the beginning of the heat-transfer surfaces of a falling film evaporator. Thus, this claim is not considered to be obvious for a person skilled in the art.

The essential technical features of independent claim 2 are similar to those in claim 1. Thus, this claim is novel and considered to have an inventive step.

In accordance with the arguments stated above, the invention in claims 1-4 is novel, is considered to involve an inventive step and has industrial applicability.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00928

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

Application No.  
Patent No.

Publication date  
(day month year)

Filing date  
(day month year)

Priority date (valid claim)  
(day month year)

US A 5930998

03.08.1999

04.12.1996

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure

Date of non-written disclosure  
(day month year)

Date of written disclosure  
referring to non-written disclosure  
(day month year)

# RECORD COPY PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only	
International Application No.	PCT/FI 99 / 0 0 9 2 8
International Filing Date	0 8 NOV 1999 (0 8. 11. 99)
The Finnish Patent Office PCT International Application	
Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference (if desired) (12 characters maximum)	302603

<b>Box No. I TITLE OF INVENTION</b>	
METHOD AND DEVICE FOR TREATING WATER FOR EVAPORATION	
<b>Box No. II APPLICANT</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)	
STERIS EUROPE, INC. SUOMEN SIVULIIKE Teollisuustie 2 FIN-04300 TUUSULA Finland	
<input type="checkbox"/> This person is also inventor.	
Telephone No.	
Facsimile No.	
Teleprinter No.	
State (that is, country) of nationality: FI	State (that is, country) of residence: FI
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input checked="" type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<b>Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)	
SALMISUO, Mauri Marsuntie 12 - 14 C 11 FIN-04320 TUUSULA Finland	
This person is: <input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)	
State (that is, country) of nationality: FI	State (that is, country) of residence: FI
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<input type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet.	
<b>Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE</b>	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: <input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
RUSKA & Co Oy Runeberginkatu 5 FIN-00100 HELSINKI Finland	
Telephone No. +358 9 694 9099	
Facsimile No. +358 9 694 9865	
Teleprinter No.	
<input type="checkbox"/> Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

Box No.V DESIGNATION OF STATES

The following designations are hereby designated under Rule 4.9(a) (mark the applicable check-boxes - at least one must be marked):

Regional Patent

- AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line) .....

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> AE United Arab Emirates                  | <input checked="" type="checkbox"/> LR Liberia                                   |
| <input checked="" type="checkbox"/> AL Albania                               | <input checked="" type="checkbox"/> LS Lesotho                                   |
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> LT Lithuania                                 |
| <input checked="" type="checkbox"/> AT Austria and utility model             | <input checked="" type="checkbox"/> LU Luxembourg                                |
| <input checked="" type="checkbox"/> AU Australia                             | <input checked="" type="checkbox"/> LV Latvia                                    |
| <input checked="" type="checkbox"/> AZ Azerbaijan                            | <input checked="" type="checkbox"/> MD Republic of Moldova                       |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina                | <input checked="" type="checkbox"/> MG Madagascar                                |
| <input checked="" type="checkbox"/> BB Barbados                              | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria                              | <input checked="" type="checkbox"/> MN Mongolia                                  |
| <input checked="" type="checkbox"/> BR Brazil                                | <input checked="" type="checkbox"/> MW Malawi                                    |
| <input checked="" type="checkbox"/> BY Belarus                               | <input checked="" type="checkbox"/> MX Mexico                                    |
| <input checked="" type="checkbox"/> CA Canada                                | <input checked="" type="checkbox"/> NO Norway                                    |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> NZ New Zealand                               |
| <input checked="" type="checkbox"/> CN China                                 | <input checked="" type="checkbox"/> PL Poland                                    |
| <input checked="" type="checkbox"/> CU Cuba and utility model                | <input checked="" type="checkbox"/> PT Portugal                                  |
| <input checked="" type="checkbox"/> CZ Czech Republic and utility model      | <input checked="" type="checkbox"/> RO Romania                                   |
| <input checked="" type="checkbox"/> DE Germany and utility model             | <input checked="" type="checkbox"/> RU Russian Federation                        |
| <input checked="" type="checkbox"/> DK Denmark and utility model             | <input checked="" type="checkbox"/> SD Sudan                                     |
| <input checked="" type="checkbox"/> EE Estonia and utility model             | <input checked="" type="checkbox"/> SE Sweden                                    |
| <input checked="" type="checkbox"/> ES Spain and utility model               | <input checked="" type="checkbox"/> SG Singapore                                 |
| <input checked="" type="checkbox"/> FI Finland and utility model             | <input checked="" type="checkbox"/> SI Slovenia                                  |
| <input checked="" type="checkbox"/> GB United Kingdom                        | <input checked="" type="checkbox"/> SK Slovakia and utility model                |
| <input checked="" type="checkbox"/> GD Grenada                               | <input checked="" type="checkbox"/> SL Sierra Leone                              |
| <input checked="" type="checkbox"/> GE Georgia                               | <input checked="" type="checkbox"/> TJ Tajikistan                                |
| <input checked="" type="checkbox"/> GH Ghana                                 | <input checked="" type="checkbox"/> TM Turkmenistan                              |
| <input checked="" type="checkbox"/> GM Gambia                                | <input checked="" type="checkbox"/> TR Turkey                                    |
| <input checked="" type="checkbox"/> HR Croatia                               | <input checked="" type="checkbox"/> TT Trinidad and Tobago                       |
| <input checked="" type="checkbox"/> HU Hungary                               | <input checked="" type="checkbox"/> UA Ukraine                                   |
| <input checked="" type="checkbox"/> ID Indonesia                             | <input checked="" type="checkbox"/> UG Uganda                                    |
| <input checked="" type="checkbox"/> IL Israel                                | <input checked="" type="checkbox"/> US United States of America                  |
| <input checked="" type="checkbox"/> IN India                                 | <input checked="" type="checkbox"/> UZ Uzbekistan                                |
| <input checked="" type="checkbox"/> IS Iceland                               | <input checked="" type="checkbox"/> VN Viet Nam                                  |
| <input checked="" type="checkbox"/> JP Japan                                 | <input checked="" type="checkbox"/> YU Yugoslavia                                |
| <input checked="" type="checkbox"/> KE Kenya                                 | <input checked="" type="checkbox"/> ZA South Africa                              |
| <input checked="" type="checkbox"/> KG Kyrgyzstan                            | <input checked="" type="checkbox"/> ZW Zimbabwe                                  |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea |  |
| <input checked="" type="checkbox"/> KR Republic of Korea                     |  |
| <input checked="" type="checkbox"/> KZ Kazakhstan                            |  |
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Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes: at least one must be marked):

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| <input type="checkbox"/> BB Barbados                              | <input type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input type="checkbox"/> BG Bulgaria                              |   |
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**Box No. VI PRIORITY CL/**

Further priority claims indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) (09.11.98) 9 November 1998	982428	FI		
item (2)				
item (3)				

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): 1

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

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**Choice of International Searching Authority (ISA)**  
(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

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**Box No. VIII CHECK LIST; LANGUAGE OF FILING**

This international application contains the following number of sheets:

request	:	4
description (excluding sequence listing part)	:	4
claims	:	1
abstract	:	1
drawings	:	2
sequence listing part of description	:	
<b>Total number of sheets</b>	:	<b>12</b>

This international application is accompanied by the item(s) marked below:

- fee calculation sheet
- separate signed power of attorney
- copy of general power of attorney; reference number, if any:
- statement explaining lack of signature
- priority document(s) identified in Box No. VI as item(s):
- translation of international application into (language):
- separate indications concerning deposited microorganism or other biological material
- nucleotide and/or amino acid sequence listing in computer readable form
- other (specify): a copy of FI search report

Figure of the drawings which should accompany the abstract: \_\_\_\_\_ Language of filing of the international application: finnish

**Box No. IX SIGNATURE OF APPLICANT OR AGENT**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

RUSKA & Co Oy

*Tord Langenskiöld*

Tord Langenskiöld  
Patent Agent

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1. Date of actual receipt of the purported international application: 08 NOV 1999

3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:

4. Date of timely receipt of the required corrections under PCT Article 11(2):

5. International Searching Authority (if two or more are competent): ISA/SE

6.  Transmittal of search copy delayed until search fee is paid.

2. Drawings:  
 received:  
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Date of receipt of the record copy by the International Bureau: 08 DECEMBER 1999

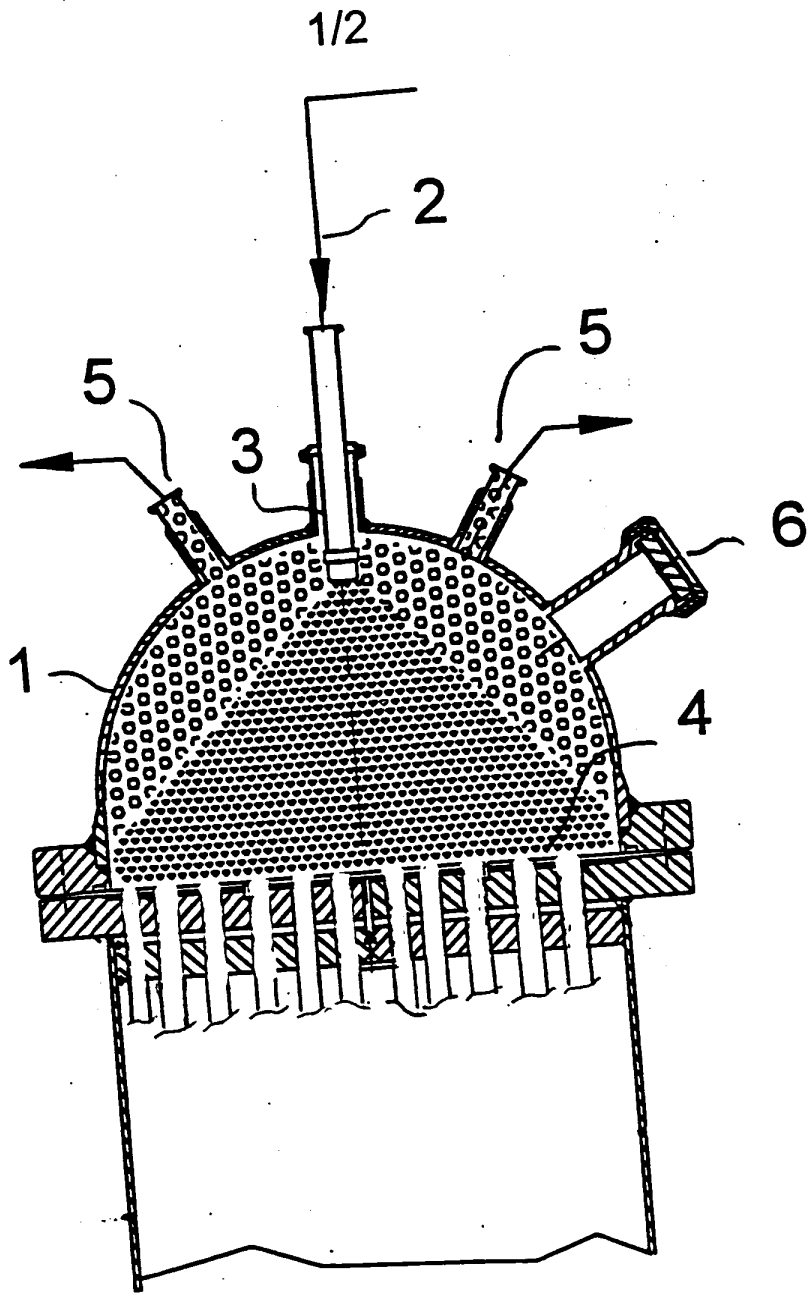


Fig. 1

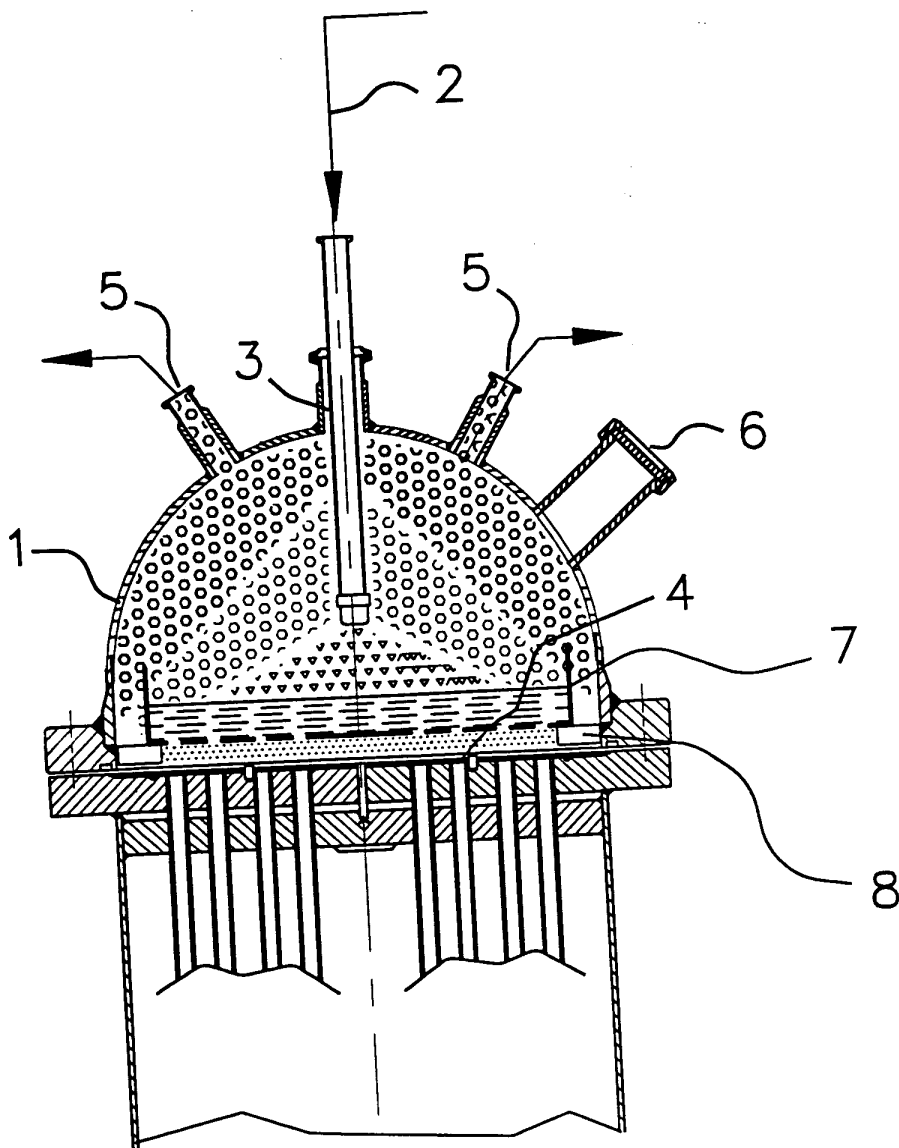


Fig.2

## Menetelmä ja laite haidutettavan veden käsittelemiseksi

### Keksinnön ala

Keksintö liittyy puhtaan höyryn tuottamiseen. Erityisesti keksintö liittyy liuenneiden kaasujen poistamiseen syöttövedestä käytettäessä putoavan kalvon haihdutinta.

### Keksinnön tausta

Tuotettaessa erityisen puhdasta vesihöyryä, erityisesti sterilointitarkoituksiin, on höyrystettävästä syöttövedestä poistettava siihen liuenneita kaasuja, mm. jotta syntyvän höyryn pitoisuus, ja sen mukana lauhtumislämpö, olisi maksimissaan ja korrodoiva vaikutus minimissään. Syöttöveteen liuenneet kaasut ovat lähinnä ilmakehän kaasuja: Typpi, happi, hiidioksididi ja argon. Kaasujen liukoisuus veteen on pienimmillään lähellä nesteen kiehumispistettä.

Esimerkiksi erään yleisesti käytetyn standardin mukaan höyryssä saa olla ei-lauhtuvia kaasuja korkeintaan 3,5 %. Liuenneiden kaasujen poistamiseksi on veden syöttölinjassa yleisesti käytetty esipoistokammioita, missä kuumennettu vesi on viipynyt kaasutilassa niin kauan että kaasuja on ehtinyt kuplia pois, kuten on esitetty esim. suomalaisessa patentissa 77 380.

Putoavan kalvon haihdutin (falling film evaporator) käsittää yleensä pystysuoran putkikimppun, jonka ulkopuolella on kuumennettava väliaine kuten höyry, lämmönsiirtoneste tai savukaasu. Haihdutettava neste syötetään ylhäältä ja valuu kalvona putkien sisäseinämiä pitkin, jolloin se osittain haihtuu. Syntynyt höyry virtaa nestekalvon mukana alaspäin ja erotetaan haihduttimen alaosassa haihduttamatta jääneestä nesteestä.

Putoavan kalvon haihduttimen pääongelma on yleensä nesteen jakaminen tasaiseksi kalvoksi putkiin. Usein käytetään tasaiseksi hiotun putkenpääntason yläpuolelle sijoitettua reikälevyjärjestelyä. Muita ratkaisuja ovat yksilölliset jakoelimet tai suuttimet putkien suulla.

Nesteiden kaasunpoistoon tunnetaan useita ratkaisuja, joissa kuuma neste hajotetaan hienoksi suihkuksi jotta syntyvien kaasukuplien erkaantuminen nestefaasista olisi suuren neste-kaasu-rajapinnan ja lyhyen kulkumatkan takia tehokas. Menetelmää käytetään höyry-

kattilaveden kaasunpoistoon, kuten esim. US-patentissa 5,201,366 ja haihtuvien aineiden strippaukseen liuosfaasista, kuten julkaisussa EP-A 167 647. Usein käytetään lisäksi alipainetta tilassa, johon nestefaasi suihkutetaan.

5 US-patentista 4,816,044 tunnetaan laite kaasujen poistamiseksi vedestä, joka on tarkoitettu käytettäväksi kirurgisena huuhteluvetenä. Laite käsittää kaasunpoistokammion, jonka yläosaan syöttövesi suihkutetaan. Kaasut poistuvat pumppujärjestelyn kautta, jolla aikaansaadaan lievä alipaine poistokammion kaasutilassa.

10 US-patenteista 3,332,469 ja 4,683,025 tunnetaan menetelmät ja laitteistot syöttöveden jakamiseksi tasaisesti putoavan kalvon haihduttimen haihdutuskanaviston alkuun käyttäen suihkutussuuttimia.

### Keksinnön kuvaus

15 Nyt on keksitty patenttivaatimuksen 1 mukainen menetelmä levittää tehokkaasti syöttövesi putoavan kalvon haihduttimen lämmönsiirtopintojen alkupäähän samalla kuin poistetaan veteen liuenneet kaasut ja estetään näiden takaisinliukeneminen. Keksintöön kuuluu myös patenttivaatimuksen 2 mukainen laitteisto, jolla putoavan kalvon haihduttimessa saavutetaan samassa vaiheessa kaasujen poisto syöttövedestä ja tämän tasainen jakautuminen haihduttimen putkikimppuun. Laitteisto käsittää haihduttimen yläosan ja ainakin yhden siihen sovitettua suihkutusvälineen. Suihkutusvälineellä tarkoitetaan tässä yhteydessä suutinta, sumutinta tai vastaavaa määrätyn muotoisen nestesuihkun aikaansaamiseksi tarkoitettua laitetta.

20 Suihkutusvälineen tai -välineiden osumakuvio on mitoitettu siten, että syötettäessä vettä välineen kautta vesi jakautuu pisaroina tasaisesti koko yläosan alla sijaitsevalle putkenpäätasolle. Pissasuihku aikaansaa myös suuren kaasu-nesterajapinnan. Koska suihkutusvälineestä purkautuva neste on kuumennettu, nesteeseen liuenneet kaasut erkanevat hyvin nopeasti nestefaasista samalla kuin osa nesteestä höyrystyy. Koska pisaroina levinyt neste faasi siirtyy hyvin nopeasti haihdutuskanavistoon, faasiin ei pääse liukenemaan kaasuja takaisin ennen kuin haihdutus alkaa, kuten saattoi olla asian laita tekniikan tason mukaisesti laitteissa ~~missä~~ kaasujen erotus tapahtui esim. erillisessä erotuskammiossa.

30 Haihduttimen yläosassa on suihkutusvälineen lisäksi yhde tai yhteitä kaasujen poistamiseksi. Osa purkautumisvaiheessa syntyvästä höyrystä toimii poistovirrassa kantajana.

Nesteen jakautumiseen haihdutuskanavistoon voidaan myös vaikuttaa sovittamalla haihdutusputkien päiden yläpuolelle rei'itetty kaukalo, johon vesi jää ohueksi kerrokseksi ennen valumistaan haihdutusputkiin. Ohuesta kerroksesta voi myös poistua liuenneita kaasuja.

## Piirustuksen lyhyt selostus

Kuvio 1 esittää keksinnön mukaisen laitteen sivuleikkausta, ja

kuvio 2 esittää keksinnön mukaisen laitteen toisen toteutusmuodon sivuleikkausta

### 5 Yksityiskohtainen kuvaus

Keksintöä selostetaan seuraavaksi lähemmin viitaten oheiseen piirustukseen. 1 on kupu-  
mainen, putoavan kalvon haihduttimen yläpää. Haihdutin muistuttaa pystyasennossa ole-  
vaa putki-vaippalämmönvaihdinta. Syöttövesi saapuu linjasta 2, ja voi siinä olla esikuu-  
mennettuna esimerkiksi 120 °C:een. Paine on linjassa 2 edullisesti noin 0,3 - noin 6 bar  
10 korkeampi kuin tuotettavan puhtaanhöyryn paine.

Suutin 3 on valittu antamaan käytetyllä painealueella osumakuvion, joka olennaisesti vas-  
taa putkenpääntason 4 muotoa ja kokoa. Sopivia, paine- ja lämpötilavaatimukset täyttäviä  
suuttimia on markkinoilla saatavilla. Suutin sijaitsee tässä toteutusmuodossa symmetrisesti  
15 kohtisuorassa putkenpääntason yläpuolella, mutta muutkin sijoitustavat ovat mahdollisia.

Useampia suihkutuskäytännöitä voidaan käyttää tasaisen osumakuvion aikaansaamiseksi.  
Kuumennetun veden purkautuessa pisarasuihkuna suuttimesta 3, pisaroista erkanevat no-  
peasti veteen liuenneet kaasut, jotka poistuvat poistoyhteiden 5 kautta yhdessä pienen  
kantohöyrymäärän kanssa. Vesipisarot, joista kaasut ovat poistuneet, leviävät tasaisesti  
20 haihdutusputkistoon, eikä putkenpääntason 4 yläpuolelle tavanomaisesti sovitettua reikä- tai

muuta jakolevyä välttämättä tarvita. Veden siirtyminen haihdutusputkien päihin on nopea,  
joten lämmönsiirto putkenseinämästä veteen käynnistyy käytännössä heti.

Suuttimen 3 etäisyys putkenpääntasosta 4 on edullisesti noin puolet tason 4 halkaisijasta.  
Laitte voi olla varustettuna näkölasilla 6.

Erkautuneet kaasut ja kantohöyry johdetaan edullisesti lämmönvaihtimeen, jossa niiden  
25 sisältämää lämpöenergiaa käytetään hyväksi syöttöveden esilämmityksessä.

Kuvion 2 esittämässä toteutusmuodossa laite on edelleen varustettu reikäpohjaisella kauka-  
lolla 7, joka on sovitettu välikeosan 8 avulla putkenpääntason 4 yläpuolelle. Tässä toteutus-  
muodossa kaukaloon 7 kertyy ohut vesikerros, josta voi vielä tapahtua kaasujen poistumis-

30 ta ennen kuin vesi siirtyy kaukalon pohjareikien kautta haihdutusputkien päihin.



Patenttivaatimukset

1. Menetelmä veden syöttämiseksi putoavan kalvon haihduttimen lämmönsiirtopinnoille levittämällä vesi pisarasuihkuna lämmönsiirtopintojen alkupäähän, **tunnettu** siitä että erotetaan samalla vedestä veteen liukoisia kaasuja.
2. Laite liuenneiden kaasujen poistamiseksi höyrystettävästä vedestä putoavan kalvon haihduttimen yhteydessä, joka laite käsittää ainakin yhden suihkutusvälineen (3) kuumentun syöttöveden jakamiseksi pisarasuihkuksi jonka osumakuvio olennaisesti vastaa haihduttimen haihdutuskanavistoasetelman yläpäädyn (4) pinta-alaa, **tunnettu** siitä että se käsittää ainakin yhden yhteen (5) pisaroista erkanevien kaasujen poistamiseksi.
3. Patenttivaatimuksen 2 mukainen laite, **tunnettu** siitä että se käsittää haihdutuskanavistoasetelman yläpäädyn (4) yläpuolelle sovitetun reikäpojhaisten kaukalon.
4. Patenttivaatimuksen 2 tai 3 mukainen laite, **tunnettu** siitä että se käsittää olennaisesti puolipallon muotoisen kammion jonka tasomaisen sivun muodostaa haihdutusputkiasetelman pääty.

## (57) Tiivistelmä

Vesihöyryn, varsinkin erityisen puhtaan höyryn tuotannossa on oleellista poistaa syöttöve-  
teen liuennaita kaasuja, lähinnä ilmakehän kaasuja. Käytettäessä valuvan kalvon haihdutin-  
ta on tärkeää saada syöttövesi levitetyksi tasaisesti lämmönsiirtopinnoille. Keksinnön mu-  
kaisessa menetelmässä ja laitteessa kaasunpoisto ja veden tasainen jako tapahtuvat saman-  
aikaisesti, kun syöttövesi suihkutetaan tasaisesti lämmönsiirtokanaviston alkupäähän hie-  
noina pisaroina, joista kaasujen poistuminen on nopea. Takaisin liukenemista ei ehdi tapah-  
tua, koska haihdutusprosessi alkaa välittömästi.



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(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

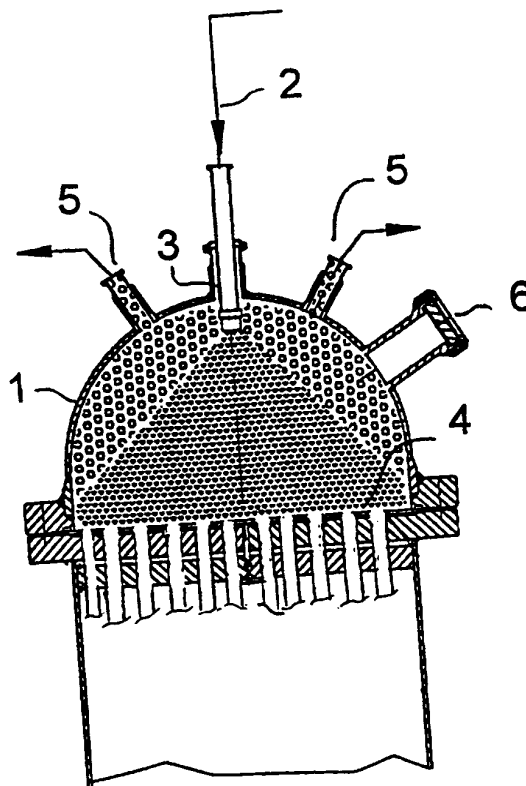
Published

With international search report.  
In English translation (filed in Finnish).

(54) Title: METHOD AND DEVICE FOR TREATING WATER FOR EVAPORATION

(57) Abstract

In the production of water vapour, in particular in the production of especially clean vapour, it is essential that the gases dissolved in the feed-water, which are mainly atmospheric gases, are removed. When using a falling film evaporator, it is important to distribute the feed-water evenly on the heat transfer surfaces. In the method and apparatus according to the invention, the degassing and the even distribution of water take place at the same time when spraying the feed-water to the beginning of the heat transfer channel assembly evenly as fine droplets from which the gases can separate quickly. There is no time for re-dissolving since the evaporation process starts immediately.



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## METHOD AND DEVICE FOR TREATING WATER FOR EVAPORATION

### Field of the invention

5 The invention relates to the production of clean vapour. In particular, the invention relates to the removal of dissolved gases from the feed-water when using a falling film evaporator.

### Background of the invention

10 When producing especially clean water vapour, particularly for sterilisation purposes, the feed-water to be evaporated has to be purified of the gases dissolved therein, among other things, to maximise the concentration of the vapour that is generated and, consequently, the condensation heat, and to minimise the corrosive effect. The gases dissolved in the feed-water are mainly atmospheric gases: nitrogen, oxygen, carbon dioxide and argon. The solubility of the gases in the water is at the lowest near the boiling point of the liquid.

15 According to a commonly used standard, for example, the vapour may not contain more than 3,5 % non-condensable gases. To remove the dissolved gases, pre-degassing chambers where the heated water has stayed in the gas space for such a long time that the gases have had time to bubble out, as is described in Finnish patent 77 380, have been used in the water feed line.

20 A falling film evaporator comprises usually a vertical tube bundle, the heating medium, like vapour, a heat transfer fluid or a flue gas being located on the outside. The liquid to be evaporated is fed from above and it flows as a film along the inner walls of the tubes, partly evaporating. The vapour that was generated flows downwards together with the liquid film and is separated from the non-evaporated liquid in the lower part of the  
25 evaporator.

Usually, the main problem with the falling film evaporator is the spreading of the liquid into an even film into the tubes. Often a perforated plate arrangement disposed above the  
30 smoothed tube end plane is employed. Other solutions are individual distributors or nozzles at the tube ends.

For the degassing of liquids, solutions are known wherein the hot liquid is broken into a fine spray to make the gas bubbles that are generated separate effectively from the liquid phase as a result of a large liquid-gas interface and a short way of travel. The method is used for the degassing of steam boiler water, as disclosed in U.S. Patent 5,201,366, for example, and for the stripping of volatile substances from a liquid phase, as disclosed in publication EP-A 167 647. Besides, negative pressure is often used in the space into which the liquid phase is sprayed.

An apparatus for the removal of gases from water to be used as surgical rinse water is known from U.S Patent 4,816,044. The apparatus comprises a degassing chamber and the feed-water is sprayed into the upper part thereof. The gases are removed through a pump arrangement generating a slightly negative pressure in the gas space of the degassing chamber.

Methods and apparatuses for distributing feed-water evenly to the inlet of the evaporator channel assembly of an evaporator by using spray nozzles are known from U.S Patents 3,332,469 and 4,683,025.

#### **Disclosure of the invention**

The method according to claim 1 has now been invented for distributing feed-water effectively to the beginning of the heat-transfer surfaces of a falling film evaporator by removing the gases dissolved in the water and preventing them from re-dissolving at the same time. Another object of the invention is the device according to claim 2 which makes it possible, in a falling film evaporator, in the same operation, to remove the gases from the feed-water and to distribute it evenly into the tube bundle of the evaporator. The apparatus comprises an evaporator top and at least one spraying device arranged therein. In this case, the spraying device is a nozzle, a mist sprayer or a similar device for creating a spray of liquid of a given shape.

The hit pattern of the spraying device or devices is dimensioned in such a way that when water is fed through the device, the water is evenly distributed as droplets over the entire tube end plane under the top. Besides, the spray of droplets results in a large gas-liquid

interface. Owing to the fact that the liquid discharged from the spraying device is heated, the gases dissolved in the liquid separate very quickly from the liquid phase at the same time as part of the liquid evaporates. Because the liquid phase distributed as droplets reaches the evaporator channel assembly in a very short time, no gases re-dissolve in the phase before the evaporation starts, as could happen in devices according to the state of the art, wherein the separation of gases was carried out, for example, in a separate chamber.

In addition to the spraying device, the evaporator top comprises an outlet or outlets for removal of the gases. Part of the vapour that was generated in the discharging phase acts as a carrier in the outflow.

The distribution of the liquid into the evaporator channel assembly can also be affected by arranging a perforated trough above the ends of the evaporator tubes, wherein the water remains as a thin layer before flowing into the evaporator tubes. Dissolved gases can also separate from the thin layer.

#### **Brief description of the drawing**

Figure 1 is a sectional side view of the apparatus according to the invention, and

Figure 2 is a sectional side view of another embodiment of the apparatus according to the invention.

#### **Detailed description**

The invention will be described in more detail below, with reference to the accompanying drawing. 1 is a dome-shaped top of a falling film evaporator. The evaporator resembles a tube and shell heat exchanger placed in a vertical position. The feed-water is delivered through line 2 where it can be in a pre-heated state of, for example, 120 °C. In line 2, the pressure is preferably about 0.3 to about 6 bar higher than the pressure of the clean vapour to be produced.

The nozzle 3 is selected to provide, in the pressure range used, a hit pattern that substantially corresponds to the shape and size of the tube end plane 4. Suitable nozzles meeting the pressure and temperature requirements are commercially available. In this

embodiment, the nozzle is placed in a symmetrically perpendicular position above the tube end plane but it can also be disposed in other ways. Further, more than one spraying device can be employed in order to achieve an even hit pattern. When the heated water is discharged from the nozzle 3 as a spray of droplets, the gases dissolved in the water separate quickly from the droplets and leave through the outlets 5 together with a small quantity of carrier vapour. The degassed droplets of water are distributed evenly into the evaporator tube assembly, and, in contrast to conventional evaporators, a perforated plate or another kind of distributing plate is not necessarily needed above the tube end plane 4. The water reaches the tube ends in a very short time, as a result of which the transfer of heat from the tube wall to the water starts practically immediately.

The distance between the nozzle 3 and the tube end plane 4 is preferably about half the diameter of the plane 4. The apparatus can be provided with a sight glass 6.

Preferably, the separated gases and the carrier steam are led into a heat exchanger where the thermal energy thereof is utilised for pre-heating the feed-water.

In the embodiment shown in Figure 2, the apparatus is further provided with a trough 7 that has a perforated bottom and that is arranged above the tube end plane 4 by means of a spacer 8. In this embodiment, a thin layer of water, from which gases still can separate before the water moves to the ends of the evaporator tubes through the bottom holes of the trough, accumulates in the trough 7.



Claims

1. A method of feeding water to the heat transfer surfaces of a falling film evaporator by distributing the water as a spray of drops to the beginning of the heat transfer surfaces,  
5 **characterised** in that water soluble gases are simultaneously separated from the water.
2. An apparatus for removing dissolved gases from water to be evaporated in connection with a falling film evaporator, which apparatus comprises at least one spraying device (3) for breaking the heated feed-water into a spray of droplets having a hit pattern substantially  
10 corresponding to the area of the upper end (4) of the evaporator channel arrangement,  
**characterised** in that it comprises at least one outlet (5) for the removal of gases separating from the droplets.
3. An apparatus as defined in claim 2, **characterised** in that it comprises a trough having  
15 a perforated bottom and lying above the upper end (4) of the evaporator channel arrangement.
4. An apparatus as defined in claim 2 or 3, **characterised** in that it comprises a  
20 substantially hemispherical chamber, the end of the evaporator tube arrangement forming the plane side thereof.

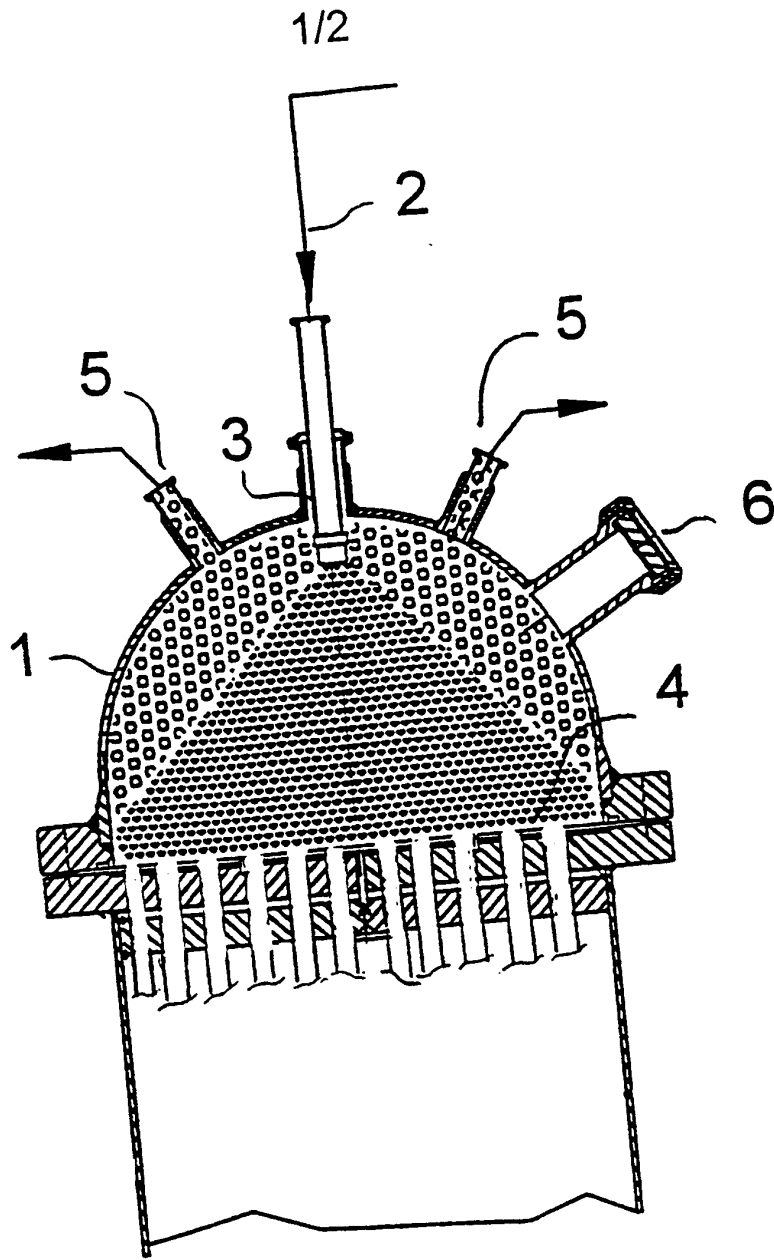


Fig. 1

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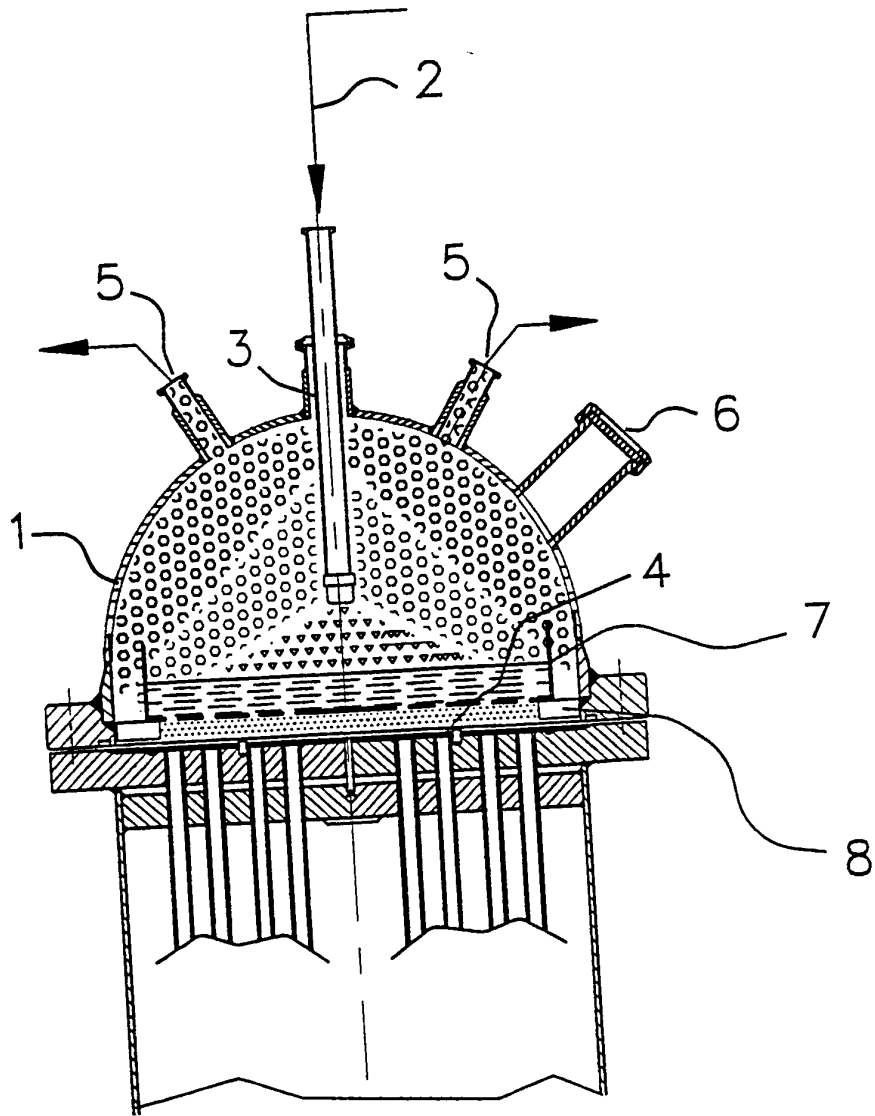


Fig.2

1  
INTERNATIONAL SEARCH REPORT

International application No.  
PCT/FI 99/00928

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B01D 1/22, C02F 1/20  
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B01D, C02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

QUESTEL: EDOC, WPIL, JAPIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4698136 A (MOHAMMED EL-ALLAWY), 6 October 1987 (06.10.87), column 3, line 17 - line 31; column 3, line 45 - line 52, figure 1	1,2,4
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P,X	US 5930998 A (FRANCISCO BLANGETTI ET AL), 3 August 1999 (03.08.99), column 3, line 50 - line 55; column 4, line 14 - line 48; column 4, line 66 - column 5, line 21, figure 1	1,2,4
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A	US 4683025 A (A. ROLAND FLORES), 28 July 1987 (28.07.87), column 4, line 63 - column 5, line 7, figure 2	1-4
	--	

Further documents are listed in the continuation of Box C.  See patent family annex.

\* Special categories of cited documents:

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- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

1 February 2000

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2  
INTERNATIONAL SEARCH REPORT

International application No.  
PCT/FI 99/00928

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A

US 3332469 A (C.F. ROSENBLAD), 25 July 1967  
(25.07.67), column 3, line 33 - line 42; column 4,  
line 3 - line 4, figures 1,2

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1-4

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/12/99

International application No.  
PCT/FI 99/00928

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